Limnol. Oceanogr.: Methods 3, 2005, 174–182

Estimation of stream nutrient uptake from nutrient addition experiments

Robert A. Payn[1], Jackson R. Webster[1 1], Patrick J. Mulholland[2], H. Maurice Valett[1], and Walter K. Dodds[3]
[1]Biology Department, Virginia Tech, Blacksburg, VA 24061, USA
[2]Environmental Science Division, Oak Ridge National Laboratory, PO Box 2008, Oak Ridge, TN 37831-6036, USA
[3]Division of Biology, Ackert Hall, Kansas State University, Manhattan, KS 66506, USA

Abstract

Nutrient uptake in streams is often quantified by determining nutrient uptake length. However, current methods for measuring nutrient uptake length are often impractical, expensive, or demonstrably incorrect. We have developed a new method to estimate ambient nutrient uptake lengths using field experiments involving several levels of nutrient addition. Data analysis involves plotting nutrient addition uptake lengths versus added concentration and extrapolating to the negative ambient concentration. This method is relatively easy, inexpensive, and based on sound theoretical development. It is more accurate than the commonly used method involving a single nutrient addition. The utility of the method is supported by field studies directly comparing our new method with isotopic tracer methods for determining uptake lengths of phosphorus, ammonium, and nitrate. Our method also provides parameters for comparing potential nutrient limitation among streams.

[1] Corresponding author.

Acknowledgments

We appreciate the help of Stev Earl, Olyssa Starry, Jack Brookshire, and Steve Thomas in the initial development of these ideas. This work was supported by grants from the National Science Foundation, DEB9815868 to Virginia Tech (NPARS) and DEB-0111410 to the University of Tennessee (LINX2).